

Case Report

INCIDENTAL DETECTION OF UNSUSPECTED PULMONARY EMBOLISM ON ONCOLOGIC 18F-FDG PET-CT

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ABSTRACT

Positron Emission Tomography- Computed Tomography (PET-CT) using 18F-FDG is widely used for the screening, staging, treatment monitoring and response evaluation of cancer patients. 18F-FDG is an analog type of radiopharmaceutical, it acts as a glucose molecule. It is widely seen that in cancer patients, the chances of pulmonary embolism (PE) is high and as such they are at increased risk (Flavell *et al.*, 2014). Venous thromboembolism is a phenomenon which is widely divided into two categories, deep vein thrombosis and pulmonary embolism (Moheimani *et al.*, 2011). FDG is taken readily by the metabolically active cells thus there is FDG uptake in atherosclerotic lesions and in vasculitis, which reflects the inflammation of vessels. The inflammation can lead to thromboembolism due to leukocyte adhesion and initiation of thrombus. Therefore there is increased uptake of FDG on the PET images in the area of thromboembolism (Rondina *et al.* 2012). Auxiliary findings of PE on PET-CT while doing scan from vertex to mid-thigh are not uncommon (Khandelwal *et al.*, 2011). We report two cases of 18F-FDG PET-CT imaging performed on cancer patients that showed evidence of PE. On 18F-FDG PET-CT a focal area of increased FDG uptake was seen in PET image without corresponding CT changes in both cases. In both the cases a follow-up PET-CT was done after 1 week of first PET-CT scan. The focal area seen in previous scan was resolved.

Keywords: *Pulmonary Embolism, PE, 18F-FDG PET-CT, iatrogenic, thromboembolism, focal area, SUV, microthrombus, microembolus*

INTRODUCTION

Veins thromboembolism is a vascular disease which is widely divided into two categories deep vein thrombosis and pulmonary embolism. The inflammation can lead to thromboembolism due to leukocyte adhesion and initiation of thrombus, eventually other cells of immune system such as neutrophils and macrophages start collecting in the developing thrombus. The risk of thromboembolism is affected by two factors acquired and genetic. Acquired factors include knee or hip replacement, major accident, injury to the spinal cord etc. whereas genetic factors include activated protein C resistance (APC- resistance) and increased level of prothrombin etc (Moheimani *et al.*, 2011). Pulmonary Embolism (PE) is a very common cause of acute cardiovascular disease & PE is the reason of thousands of death each year because it often goes undetected (Wittram *et al.*, 2007). A blood clot that occurs in the lung when clot in another part of the body moves through the bloodstream and becomes lodged in the blood vessels of the lung is known as PE (Waugh *et al.*, 2001). An iatrogenic PE shows uniform focal FDG uptake in the lung without any corresponding structural lesion on CT (Kumar *et al.*, 2016). Here we report two cases of PE that signify the importance of careful interpretation of incidental findings on PET-CT imaging as they can have a significant effect on patient management.

CASES

Case 1

Case History: A 37 year old female, with clinical diagnosis of invasive ductal carcinoma of left breast had come for 18F-FDG PET-CT for restaging. When patient was diagnosed with carcinoma she was 34 weeks pregnant i.e. Gestational breast cancer with clinical staging T2N1 M0. LSCS was done at 36 weeks 6 days

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of pregnancy with left breast conserving surgery with axillary clearance. The hormone receptor status was ER positive, PR positive and Her/2neu negative. Patient received radiation therapy of 4000 cGy dose in 20 fractions over 3 weeks. Patient also received 6 cycles of chemotherapy.

Imaging Findings: On 18F-FDG PET-CT a focal area of (approx. size 1 cm) increased FDG uptake [SUV max 7.17] without corresponding CT changes was noted in the superior segment of the lower lobe of the right lung (Fig.1). In the follow-up PET-CT which was done after 1 week of first PET-CT scan the focal area seen in previous scan was resolved (Fig. 2). This was a clear case of pulmonary micro-embolism.

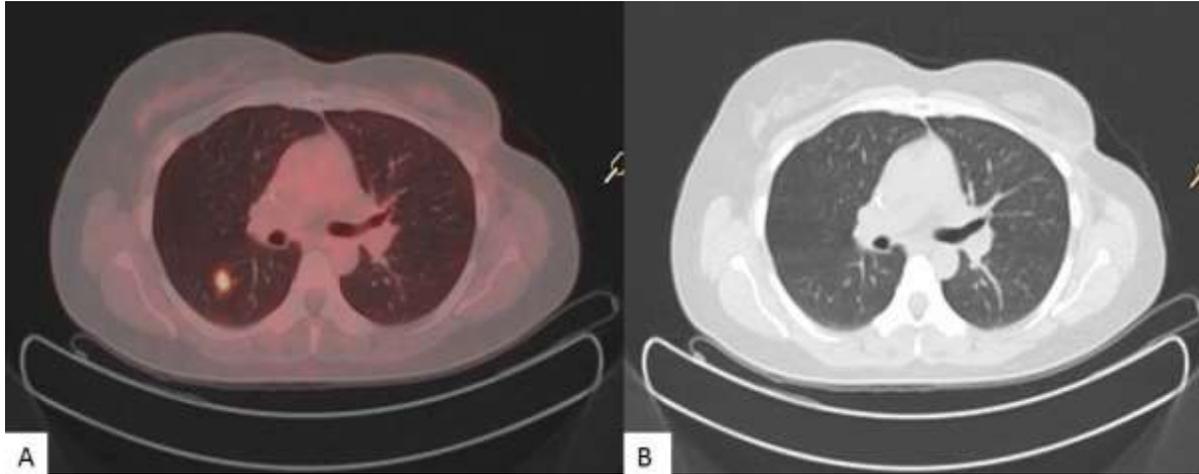


Figure 1: Fused FDG PET CT showing focal FDG uptake in right lung (A) but corresponding CT images does not show any structural abnormality (B)

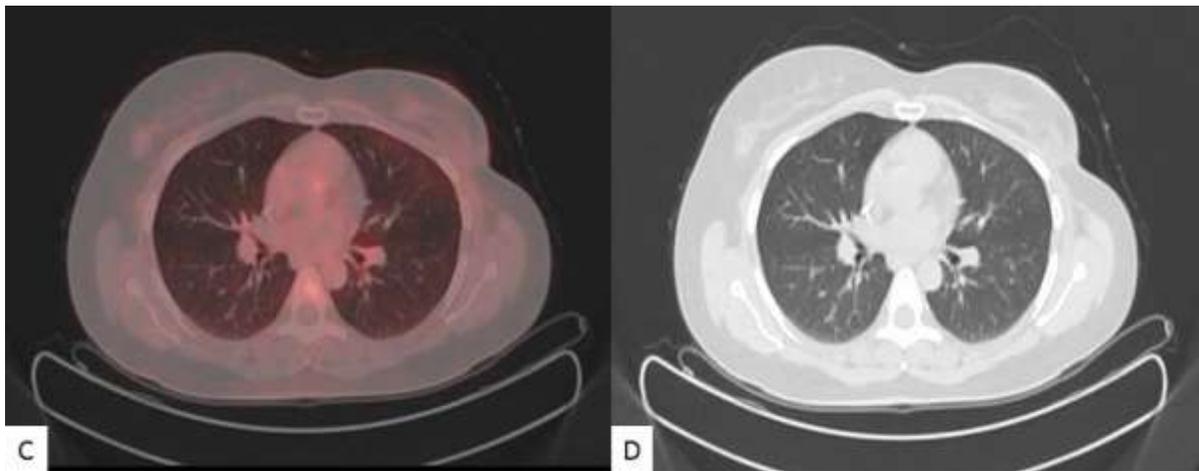


Figure 2: Second FDG PET-CT scan done showed disappearance of the focal (C) uptake in lung and no lesion on CT image (D)

Case 2

Case History: A 58 year female with clinical diagnosis of post-operative ductal carcinoma of right breast having ER negative, PR negative and Her/2neu positive status, came for 18F-FDG PET-CT for restaging of disease. Patient had also received 6 cycles of chemotherapy.

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Imaging Findings: On 18F-FDG PET-CT, focal area of subcentimetric size of increased FDG uptake [SUV max 6.56] without corresponding CT changes was noted in the posterior segment of the upper lobe of right lung (Fig.3). As seen in the previous case; a follow-up PET-CT which was done after 1 week for this patient, the focal area seen was resolved (Fig. 4). This was also a case of pulmonary micro-embolism.

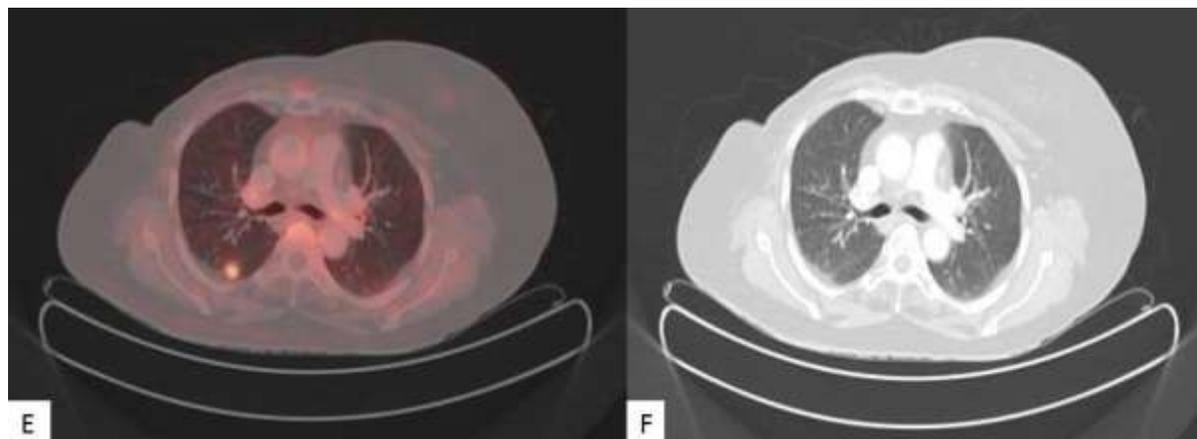


Figure 3: Fused FDG PET CT showing focal FDG uptake in right lung but corresponding CT images does not show any structural abnormality (F)

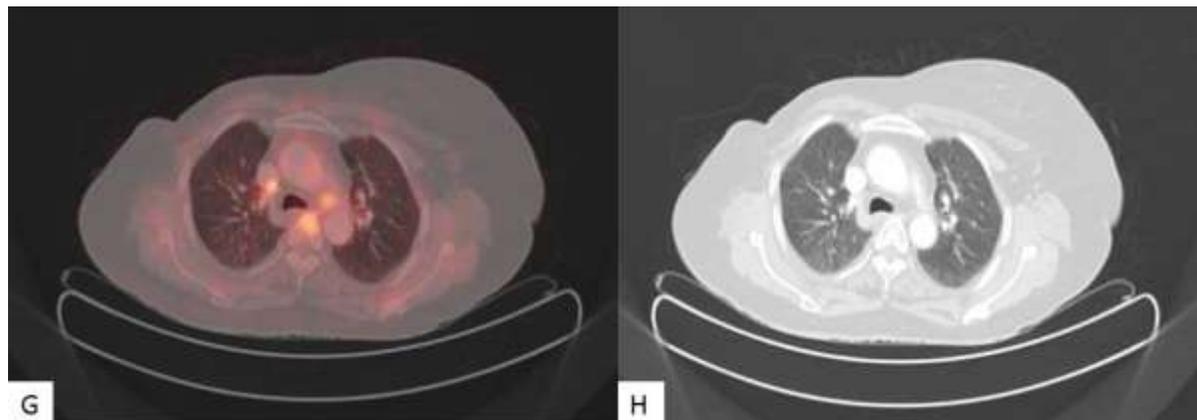


Figure 4: Second FDG PET-CT scan done showed disappearance of the focal uptake in lung (G) and no lesion on CT image (H)

DISCUSSION

Pulmonary embolism results in the high level morbidity and mortality. Injury to blood vessels, decrease blood flow and prothrombotic blood composition known as Virchow's triad is the classical predisposing factors to PE. The acquired predisposing factors are trauma, recent surgery, sepsis, immobilization etc. (Tubaro et. al. 2018).

Tokmak *et al.*, (2013) reported a microembolism in 48 year old female suffering from gastric cancer. FGD PET CT performed on this patient showed FDG avid area in the middle lobe of the right lung parenchyma without any structural abnormality on the CT. In repeat study which was done after 4 days the previous FDG avid area was not seen i.e. resolved.

Kumar *et al.*, (2016) also reported FDG embolism in right lung on 18F-FDG PET-CT in a 75 year old female who had come for staging of squamous cell carcinoma arising from base of tongue.

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Flavell *et al.*, (2014) retrospectively reviewed the FDG PET-CT of 65 oncology patients. They found incidental pulmonary embolism (IPE) in 0.32% of PET-CT scans. They concluded that there is higher risk of PE in oncology patients. In oncology patients these asymptomatic PEs are significant clinically. For deep venous thromboembolism they serve as markers.

So there should be an understanding of physiological distribution and false positive findings for correct interpretation. Uptake of FDG in pulmonary system can occur due to various reasons such as metastasis, inflammation and infection; these are associated differently with structural abnormality on corresponding CT images.

FDG is taken readily by the metabolically active cells as in atherosclerotic lesions and in vasculitis. The inflammation can lead to thromboembolism due to leukocyte adhesion and initiation of thrombus, which ultimately moves to lung; therefore there can be FDG avid area in lung without corresponding abnormality on CT images. It is crucial to have knowledge about these and it also signifies the value of fused PET CT, as misinterpretation may lead to false positive findings like misinterpreting a focal FDG uptake in lung as a site of metastasis in a known carcinoma patient if there is no corresponding CT image. Therefore it is recommended to do a follow up scan to know the exact patient condition. In the follow –up scan lesion must be resolved if it is a PE (Bikkina *et al.*, 2017).

CONCLUSION

In oncologic patients FDG avid micro embolism can be seen due to various iatrogenic factors. Inability to recognize pulmonary embolism may lead to hazardous consequences with patient's health. Therefore knowledge regarding the identification of PE on FDG PET-CT image is essential.

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